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THE UNIVERSITY OF NAIROBI
COLLEGE OF AGRICULTURE AND VETERINARY SCIENCES
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PROJECT REPORT

ON

QUALITY ANALYSIS OF LAYERS FEEDS IN THE KENYAN MARKET

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**THIS REPORT WAS SUBMITTED FOR PARTIAL FULFILLMENT OF THE
REQUIREMENT FOR THE DEGREE OF BACHELOR OF VETERINARY MEDICINE,
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Declaration

I, Miano Wilson Ndirangu declare that this project report entitled " **Quality Analysis of layers feed in the Kenyan market**", submitted by me to the university of Nairobi as a requirement for the award of the degree of Bachelor of veterinary medicine is my own work, carried out under the supervision of **professor R.G. Wahome**, department of **Animal Nutrition**.

The findings reported in this project have never been submitted for any degree or diploma certificate in University of Nairobi or any other university or college.

Dedication

I dedicate this project to my uncle David Theuri and his family. Through my experience at their home, I got the insight to carry out this wonderful project

Further dedication to my parents, Joseph Miano and Mary Wanjiru for their unfading support all throughout the project and above.

Acknowledgement

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Finally, the technologists, **Ann Kimende, Benjamin Kyalo** for their guidance and

demonstrations on how to go about the various procedures in proximate and mineral analysis.

Abstract

This study was carried out to evaluate the quality of layers feeds we have in the market from the major producers.

Proximate analysis and calcium and phosphorus analysis were done on a total of six samples, **unga, jubilee, sigma, savanna, pembe and Belfast**. The results were compared with the recommended levels as stipulated on the Kenya bureau of standards, KEBS to determine if they met the quality required.

The study aimed at investigating the continued complain from layers farmer about low production from their flocks despite the fact that they fed what they believe is the best feeds from the market. Also, customers are complaining about the egg sizes and the fragility of the eggs during handling.

List of abbreviations

1. KEBS ó Kenya Buruea of standards
2. AKEFEMA- Association of Kenya Animal Feeds Manufacturers
3. MoLD- Ministry of Livestock Development
4. DVS- Director of Veterinary Services

5. GOK- Government Of Kenya

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1. Introduction

Poultry production is divided into three groups, broilers, layers and indigenous. Broilers are for meat production while the layers are for table eggs production. The indigenous are those that are kept for multipurpose including brooding and eggs production.

Due to the increasing cost of animal meat, eggs have become so popular in the provision of animal protein in the country's population. This is because they are much cheaper as compared to meat. Vegetarians also tend to consume such eggs from those layers bird (since they are not fertilized, they argue out that they are lifeless). This has led to the shooting of the egg demand substantially.

With such high demand for eggs, eggs production fits the description of most of the entrepreneur farmers, of a lucrative enterprise, especially those neighboring urban centre since the demand and market is already there. The fact that the production is not so much space demanding adds to its practicality bearing in mind that such neighborhood are characterized by land limitation.

As expected, the fact that most of the layers are kept enclosed means that they must be provided by commercially produced feeds. It's estimated that due to this factor, almost 70% of all cost of layers production goes to feed. Luckily, there are more than enough layers feed producers in the country. Thus, the problem of sources of the feeds is well solved. However, this occurs at a cost. Those feeds are relatively high priced.

Nevertheless, most of the farmers are constantly complaining about the mediocre performance of their birds despite maintaining top management and housing levels and feeding what they presume to be best quality layers feeds. Some of the farmers has recorded an almost 10% egg

production in their farms way too below the recommended of 80%. This translates to very huge losses to the farmers and also it does not help in the solving the demand of the eggs by the population.

According to farmers, they suspect that the feeds they are getting from the market are not meeting the minimum nutrients requirements for the bird, leading to such low performances.

This project aimed at analyzing the quality of feeds from different producers that were available in the kikuyu market. The assumption was that such analysis would give an idea of the quality of feed to expect in the Kenyan market.

1. LITERATURE REVIEW

2.1 ANIMAL FEEDS MANUFACTURING IN KENYA

Most animal feed manufacturers in Kenya practiced what is known as mixed

Feed production (*Karuri 2010*). This means that they produced feeds for dairy cattle, poultry, and pigs on the same site. The first firm to produce mixed feeds was established in Kenya in the 1950s. Since then, the feed industry has grown not only in terms of the volume of feed produced but also by putting in place policies to ensure quality feed production. In 1976, the government established the Kenya Bureau of Standards (KEBS). By the end of the decade, specifications for poultry, dairy, and pig feeds had been implemented. By 2010, there were 94 mixed feed manufacturing firms in Kenya, most of which were wholly locally owned. Animal feed production ranged from less than 1,000 tons to over 100,000 tons per annum for the small and big firms respectively (*Mbugua, P. N. 2010*). The larger millers used computerized technology (imported continuous of mixers) that facilitated higher output, while the small millers employed low investment, labor-intensive production technology. The total installed feed production capacity was about 843,000 tons, of which only 44.5 percent was utilized. This underutilization ó which at times prompted the closure of some mills ó was owed to the lack of reliable quality

raw materials/feed ingredients and in some cases, farmers' inability to purchase the feeds (preferring to grow their own feed on their farms).

The objectives of mixed feed manufacturing were to:

- É Produce feed that was safe for animal use;
- É Produce feed that ensured that the food product arising thereof was safe to the human consumer;
- É Produce feed that meets the nutritional requirement of the animal; and
- É Make a profit through the feed manufacturing Endeavour.

KEBS was held responsible for ensuring the achievement of the first three qualities

Objectives. Feed manufacturers were subjected to a rigorous Certification and standardization process before they could be permitted to sell their feeds. The manufacturers were re-certified every three years to ensure they maintained their quality, but KEBS could conduct a feed quality audit at anytime

The growing number of manufacturers came up with an organization called Association of Kenyan feeds manufacturers, AKEFEMA. This is a canopy organization of accredited feed manufacturers in Kenya. It was established in early 2003 and registered in 2004 under Section 10 of the Societies Act. With Ministry of livestock development, MoLD persuasion, its formation was driven by the need to enhance quality and affordability of feed stocks and services delivery in the feeds industry. This was perceived as a necessary condition for future growth and development in the livestock sector. Limited availability of good quality, affordable feeds has been a setback for the livestock sector in Kenya. As noted earlier, farmers attribute decline of milk and egg production to poor quality of feeds that are produced locally and/or non-affordability of these feeds due to high feed prices. Therefore, there was need for stakeholders to create a body that would help alleviate these challenges.

Currently, AKEFEMA has over 100 registered members. Its core mandate is to coordinate and promote self-regulation in the feed manufacturing industry and lobby for feed industry enabling environment. Other roles of AKEFEMA include steering of

animal nutrition research activities, disseminating knowledge on animal feeds manufacturing, promoting market access by livestock farmers through collective action, link its members with both government and non-government organizations, and providing a platform for public-private partnership in the feed industry.

AKEFEMA is in the process of developing its certification codes in the form of 5-star rating which will be granted to its members after a comprehensive appraisal of the production process and procedure. This certification will ensure quality feeds to consumers since rating will help to instill consistency in production of animal feeds. The rating system is in harmony with KEBS standards as well as international codes of practice.

2.2 LAYERS FEEDING STANDARDS

According to poultry hub, the aim of layers diet is to optimize egg production (*in terms of egg number, egg size or egg mass*), provide the nutrition required to safeguard health and maintain the desired body weight. (www.poultryhub.org/nutrients)

Because of the high nutrients content of the egg, and the high level of production of the modern layers hen, the nutritional requirements of the bird in full production are very high, particularly for protein, energy, calcium and phosphorus. (*Peter R. Cheeke, 1991*)

The Kenya bureau of standards has taken the necessary tests to set the standards by which every layers mash producers is expected to meet.

Table 1: Kenya bureau of standards specification for layers feeds

Nutrients	Amounts
Moisture, % (maximum)	20
ME, kcal/kg (minimum)	2750
Crude protein, % (minimum)	16
Crude fiber, % (maximum)	6
Crude fat, % (maximum)	6
Calcium, % (minimum)	3.4

Available phosphorous, % (minimum)	0.4
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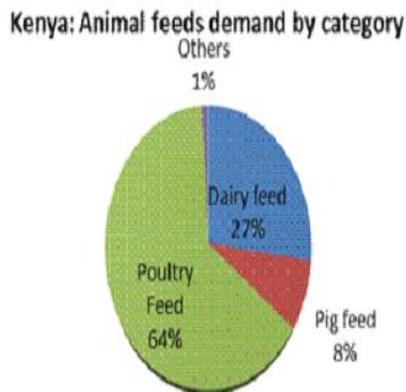
Source, Prof Mbugua notes

2.3 PREVIOUS ASSESSMENT OF FEEDS QUALITY

The use of manufactured animal feeds and feed supplements in Kenya has increased steadily over the last ten years. Data by Kenya's State Department of Livestock estimates that demand for feeds and supplements is about 650,000 tons up from 300,000 tons in 2008. Registered feed manufacturers account for about 60 percent of the demand; while the unregistered small scale manufacturers, home/community-based formulators, and importers account for the balance. Some of the challenges facing the animal feeds industry in Kenya include erratic supply of raw materials, lack of Standardization and low quality of ingredients. (Kennedy kimani, 2014).

The size of the animal feed industry in Kenya has been steadily increasing in the last ten years, mainly due to the growth of the livestock subsector. In 2008, there were about 100 registered livestock feed manufacturers, and by 2013 the number had increased to about 150. Of these, twenty are also large grain millers, and eight are oil seed manufacturers. There are also nearly fifty registered raw material importers and six suppliers of feed premixes (mineral, vitamin and other mineral elements). In addition, there are hundreds of home/community-based formulators whose growth is driven by the desire by farmers to contain spiraling production costs this is as described by *Kenya feed industry policy and regulatory issues .(2013) (sub-report iii)*.

The poultry and dairy sub-sectors in Kenya absorb most of the feed. Both subsectors are based on intensive production systems and located in high potential rural and semi-urban areas, where commercial demand for milk, egg and meat is high. In the lower potential rural areas, extensive livestock keeping is practiced, and livestock nutrition is rarely supplemented with concentrates. (Joshua, (2012)



Source: State Department of Livestock, Kenya and AKEFEMA

Kenya Bureau of Standards (KEBS) is the statutory body charged with enforcement of standards and certification of all products and services in the country. In the animal feed industry, most of the smaller feed formulators are unregistered, unregulated and even difficult to trace and therefore easily evade the oversight of KEBS. In addition, most feed ingredients are themselves are not fully standardized causing feed manufacturers great difficulties in complying with the set overall feed standards. The enforcement of the Fertilizer and Animal Foodstuffs Act is the responsibility of the Director of Veterinary Services (DVS).

The quality of commercial feeds, assessed in terms of nutrient composition as well as the presence or absence of substances that may be harmful to human and animal health has been a major concern amongst the stakeholders in Kenya. Aflatoxin contamination has particularly been of great concern in view of the possible incriminating sources of the cereal based ingredients. Although the GOK has indicated its commitment towards better quality control, the lack of sufficient capacity is palpable.

Kenya feed industry does not have adequate standards for ingredients and quality control of the by- products and ingredients that are imported for the feed industry. Lack of

accredited feed analysis laboratories to ascertain raw material chemical composition has also contributed to poor feed quality.

Thus in conclusion most of the feeds hardly meet the recommended standards.

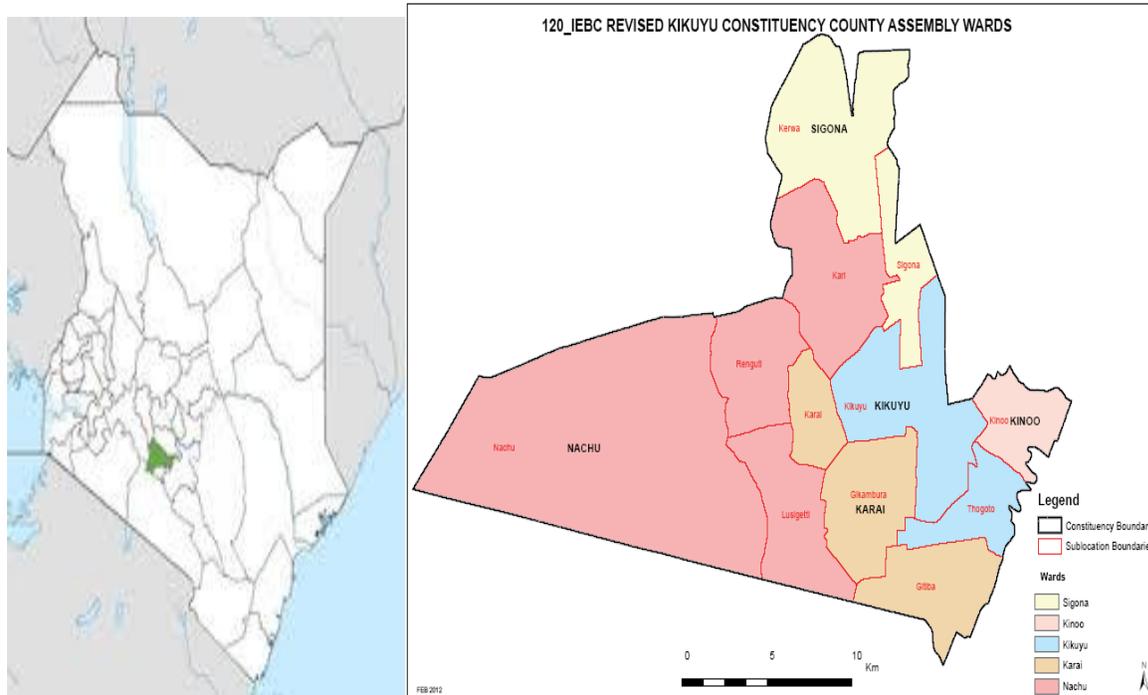
2. MATERIALS AND METHODS

3.1 Study Area

All samples were collected them from kikuyu town, in kiambu county. It is located 20 km northwest of central Nairobi, the capital of Kenya.

Due to its geological, weather and location factors, there is much livestock and crop farming. Its proximity to the capital city ensure a very high demand for their agricultural and animal products.

Among the booming livestock production activities is poultry farming particularly the egg production sector. For this fact, the town is crowded by many distributor of layers mash from almost every producer in the country. This distributor ranges from small agro vet owners to specific producer distributors.



3.2 SAMPLE COLLECTION

I went from store to store asking which layers feeds they had in stock and then requested to be sold a kilogram of each feed type. By the end of the day, I had collected a kilogram of each feed that was available in that town from the various producers.

3.3 CHALLENGES

Most of the distributors kept huge packages of the feed and they were reluctant to sell in small amounts. Luckily, I could find easily another distributor who had packaged those small amounts. This was possible due to the fact that most of the farmers are small scale and can only afford such small quantities.

Another challenge was that some of the distributors suspected I was doing some form of inspection and thus my efforts to get feed from them were futile. All the same, the problem solved its self as some with the same brand of feed were more than willing to sell to me.

3.4 SAMPLE ANALYSIS

In all the six samples that I collected, I did proximate analysis and calcium and phosphorus analysis.

Proximate analysis is a time honored standard chemical method of feed analysis, *peter cheeke 1991*. It involves some simple chemical techniques designed to differentiate nutrient components from nonnutritive materials. The components of proximate analysis are dry matter, crude protein, ash, moisture, ether extracts and nitrogen free extracts.

I analyzed for phosphorous using photospectrometry while for calcium I used flame emission spectroscopy.

I followed the procedures as described in, laboratory procedures in animal nutrition research, *Galyean, 2010*.

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3. Results and discussion

4.1 General Nutrient levels in Kenyan Feeds

Table 1. Descriptive statistics of the layer feed sample analysis

	Standards	Minimum	Maximum	Average	StDev.
crude fibre	6	7.00	9.35	8.18	0.91
ether extract	6	1.96	5.86	3.51	1.38
crude protein	16	12.11	16.16	14.12	1.56
calcium	3.4	4.57	8.32	5.77	1.49
phosphorous	0.4	0.26	0.53	0.42	0.13
DM	80	90.54	92.68	91.40	0.83
ME (Mcal /kg	2.75	2.55	2.86	2.68	0.11

This table clearly shows that there is a lot of deviation from the standard of the different nutrients contents on the average of all the feeds analyzed. The major deviations of layers production importance are in the;

- Crude fiber content
- Crude protein content
- Metabolizable energy content
- Phosphorous amounts

Some of these deviations are on the lower end meaning that the feeds do not reach the minimum requirement, for example, in the crude fiber content and metabolizable energy.

Others are deviations on the maximum end meaning that the feed have an excess of some of the nutrients. This is more clearly on the crude fiber content.

The excess or/and limitation of these nutrients has certain implication on egg laying percentage as well as in egg size. This is looked on in a more detailed manner on the following subsequent tables.

4.2 DEVIATION OF NUTRIENT LEVELS FROM THE STANDARDS

Table 2. Deviation of analytical results of specific feed company formula from the standards

	Feed 1	Feed 2	Feed 3	Feed 4	Feed 5	Feed 6
moisture	10.8	9.5	9.9	11.6	11.3	10.3
crude fibre	-3.0	2.3	-2.3	0.9	-7.5	-8.1
ether extract	0.1	2.1	3.0	3.5	2.2	4.0
crude						
protein	-0.8	-3.9	-1.0	-3.0	-2.7	0.2
calcium	1.2	1.2	1.5	4.9	3.4	2.1
phosphorous	0.1	0.1	0.0	0.1	-0.1	-0.1
ME (Mcal						
/kg	0.1	0.0	-0.1	-0.2	0.0	-0.2

This table is simply trying to demonstrate all those nutrients that deviated from the standards.

Those with negative figures represent those deviations that were contrary to the expectations of the KEBS as far as layers feeds are concerned either to the positive or the negative.

From this table, it's evident that none of the feed fully satisfied all the nutrients requirements in totality; feed 2 had only one deviation, feed 1 and 4 had two deviations, feed 3, 5 and 6 had three deviations.

The nutrient of importance significantly affected was crude protein, crude fiber, metabolizable energy and phosphorous. The calcium in all the feeds reached the minimum requirement.

4.3. CRUDE FIBRE LEVELS IN THE FEED

Table 3. Ranking of companies by deviation from recommended crude fibre levels

Company	crude fiber	Rank from the worst to the best
Feed 6	-8.0796	6
Feed 5	-7.47595	5
Feed 1	-2.9711	4
Feed 3	-2.3464	3
Feed 4	0.867983	2
Feed 2	2.3464	1

The table above show serious deviations from the standards of the crude fiber of the various feeds; feed 6, 5, 1, 3, 4, 2. Feeds 4 and 2 did not exceed the recommended level.

Crude fiber is very important in the birds digestion processes and nutrients availability, *Robert et al 2014*. However, an excess of it can pose many adverse effects. Among the major effects is the negative effect it has on the voluntary feed intake. Increased crude fiber content reduces voluntary feed consumption in poultry. This is because they occupy the crop activating the satiety centre thereby inhibiting the need to take more feeds. With the feed nutrients status of the feeds we have In the market, where they hardly meet the minimum nutrients requirements, such birds are very likely not to meet their daily nutrients requirements and any reduction on their voluntary feed intake will just worsen the situation.

From the study (*High-Fiber Diets with Reduced Crude Protein for Commercial Layers*), feed conversion ratio (kg feed/dozen eggs) there was a significant difference when diets with a

higher crude fiber were compared with the standard treatment. The test birds were poor in feed conversion ration as compared to those feed on the standard.

4.4 CRUDE PROTEIN LEVELS IN THE FEED

Table 4. Ranking of companies by deviation from recommended crude protein levels.

Ranking of feeds	
From worst to	
best	crude protein
Feed 2	-3.892
Feed 4	-3.0118
Feed 5	-2.7394
Feed 3	-1.0136
Feed 1	-0.7892
Feed 6	0.1551

From the above table, only feed 6 reached the KEBS recommendation. All the others had a deficiency with feed 2 having the greatest deficiency and feed 1 the least.

Crude protein is among the most limiting factor in layers performance. In the feed production industry, crude protein sources also falls on the most expensive raw materials. For this reason, most of the manufacturers hardly meet the minimum requirement in their quest to maximize on their profit margin.

Reducing crude protein levels results in **reduction** in both **performance characteristics** and **egg quality**. *Gbemiga at el, 2012*. Reducing crude protein levels below the recommended 16% results in reduced weight gain, food conversion ratio, hen day production and egg number. It also leads to significant reduction of egg weight (size), yolk index, albumen index, shell thickness and haul units.

4.5 PHOSPHORUS LEVELS IN THE FEED

Table 5. Ranking of companies by deviation from recommended phosphorous levels.

Ranking of feeds from worst to best	phosphorous
Feed 5	-0.142
Feed 6	-0.14
Feed 3	0.028
Feed 2	0.112
Feed 1	0.126
Feed 4	0.134

Feed 5 and 6 did not meet the required phosphorous levels. The others did meet this requirement.

Of all the poultry species, the laying hen needs much phosphorous largely because of concerns of inadequate mineralization of eggshell, and skeletal abnormality which results in poor egg production, morbidity and mortality. Therefore, with the low phosphorous in the formulation of the two feed companies, it would result in decreased laying percentage, *Kovacs et al, 2006*.

4.6 FEED METABOLIZABLE ENERGY

Table 6. Ranking of companies by deviation from recommended ME levels.

Ranking of feeds from worst to best	ME (Mcal /kg)
Feed 6	-0.20284
Feed 4	-0.15975
Feed 3	-0.09916
Feed 5	-0.03586
Feed 2	-0.02499
Feed 1	0.110584

From this table, its evidence that only feed 1 meet the minimum KEBS standard. All the other feeds didn't.

Birds can efficiently adjust feed intake to maintain energy intake when feed diets with varying ME content (Singh *et al.*, 2005). The daily feed intake increases as the energy levels of the diet increases. However, the fact that the feed had a lot of fiber results in reduced compensatory capability as the fiber fills the crop and the gut and reduces intake and digestibility.

Diets that are suboptimal in energy, little increase in size will be noted by increasing protein, (Leeson, 2001). The reason is that the hen will utilize protein to meet its energy requirement. Therefore, one of the main factors limiting egg size is energy intake.

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4. CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSIONS

The layers feed picture presented by these finding from the six different companies is unsatisfactory and puts the entire layers production in a huge feeds problem.

I therefore conclude that most layers feeds do not completely meet the KEBS nutrients specifications.

Among the most affected nutrients are crude protein, crude fiber and metabolizable energy. These three nutrients are major determinants of birds laying percentage and egg size. Therefore, the complaints from both layers eggs producer and the consumers are justified as of the quality of feeds available in the market can only yield low production and small sized eggs..

5.2 Recommendations

The government needs to pay more attention in feed quality supervision and enforce censoring of companies making substandard -layers feeds. This can be achieved by the government making the necessary equipments for testing the feed quality available and feed quality inspectors in regional or county centre to facilitate higher and more effective frequency of feed surveillance and testing.

The farmers need -familiarization on feed -formulation using locally /easily available materials. The extension officers need to facilitate these actions while paying attention to cost of production.

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